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SCREENING TESTS OF ADDITIONAL COMPOUNDS FOR TOXICITY TO THE SOUTHERN POTATO WIREWORM

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Results of 1957 and 1958 laboratory tests of the toxicity of certain compounds to larvae of the southern potato wireworm (Conoderus falli Lane) were published in 1959 (Cuthbert and Reid[2/]). These tests were continued through 1960, and this paper reports results obtained with additional compounds.

The insecticides were mixed for 15 minutes with screened, air-dried soil in a small electric pebble mill. Emulsifiable or wettable-powder concentrates of the insecticides were mixed with enough water so that 25 ml. of liquid was added to each quart of soil. The soil mixtures were held in polyethylene bags until used.

Approximately 40 ml. of the treated soil was placed in each of 20 3-ounce salve cans within 24 hours (4 hours for volatile materials) after the insecticide was added. One wireworm was immediately put in each can. Field-collected larvae were used prior to 1960; larvae reared in the laboratory from field-collected adults were used in 1960. A kernel of boiled corn was provided as food. As far as possible, equal numbers of larvae of different sizes were exposed to each dilution of the insecticide, but at times some sizes were difficult to find in the field. These tests showed little effect of size on the reaction of larvae to insecticides, although the very small ones appeared to be slightly more susceptible. DDT and parathion standards were included at least once every 3 weeks, and untreated checks each week. The cans were examined 3 to 5 days after the tests were started and at 2-week intervals thereafter. The number of dead or moribund larvae were recorded at each examination and food and water added as needed. All tests were terminated at the end of 9 weeks.

1/ In cooperation with the South Carolina Agricultural Experiment Station.

2/ Cuthbert, F. P., Jr., and Reid, W. J., Jr. 1959. Screening tests of compounds for toxicity to the southern potato wireworm. U. S. Dept. Agr. ARS-33-54.

The compounds tested, the dosages, and the mortality of the wireworms at various intervals, adjusted for the untreated checks, are shown in table 1. The chemical names of the new proprietary materials tested precede the table.

The toxicities of parathion and of DDT at dosages equivalent to 1/4 pound and 20 pounds per 6-inch acre, respectively, were used as a basis in evaluating results of these tests. Extensive use of these two materials in commercial potato plantings in Charleston County has shown that both are capable of providing adequate control of the southern potato wireworm with certain limitations. Parathion at 2 pounds per acre is highly toxic, but its short residual action results in poor control when the larvae, either because of their location or inadequate mixing of the insecticide into the soil, are not contacted within a few weeks after its application. DDT at 20 pounds per acre is only moderately toxic, particularly in soils of high organic content, but this deficiency is partially offset by a long residual action.

None of the compounds tested were more toxic than parathion to the southern potato wireworm. Six organic phosphates, Bayer 29952, Bayer 30237, Bayer 30468, Bayer 30911, Bayer 41831, and Monsanto CP-11549 were equal to or only slightly less effective than parathion. Most of the phosphates were not tested at a dosage of more than 2 pounds per acre and thus cannot be compared with DDT.

Of the compounds that were not organic phosphates, two carbamates, Bayer 39007 and Hercules 5727, one chlorinated hydrocarbon, Velsicol 53-CS-17, and one nitro phenol, Bayer 28589, were more toxic than DDT. One carbamate, Bayer 37344, was about equal to DDT.

Chemical Names of the New Proprietary Materials Tested

Bayer 22408 ..... O,O-diethyl O-napthalimido phosphorothioate
Bayer 22684 ..... 2-chloroethyl 2, 2-dichlorovinyl methyl phosphate
Bayer 24498 ..... O,O-dimethyl S-2-(methylsulfinyl)ethyl phosphorothioate
Bayer 25141 ..... O,O-diethyl O-(p-methylsulfinyl)phenyl phosphorothioate
Bayer 25198 ..... O,O-dimethyl O-(p-methylsulfinyl)phenyl phosphorothioate
Bayer 28589 ..... 2,6-di-tert-butyl-4-nitrophenol
Bayer 29493 ..... O,O-dimethyl O-(4-methylthio-m-tolyl) phosphorothioate
Bayer 29952 ..... O-ethyl O-(p-methylthio)phenyl methylphosphonothioate
Bayer 30237 ..... O-methyl O-(p-methylthio)phenyl methylphosphonothioate
Bayer 30468 ..... O-ethyl O-(p-ethylthio)phenyl methylphosphonothioate
Bayer 30554 ..... O-methyl O-(p-methylsulfinyl)phenyl methylphosphonothioate
Bayer 30911 ..... O-(2,4-dichlorophenyl) O-methyl methylphosphonothioate
Bayer 34042 ..... O-ethyl O-(4-methylthio-m-tolyl) methylphosphoramidothioate
Bayer 34098 ..... O-(4-methylthio-m-tolyl) dimethylphosphinothioate
Bayer 37344 ..... 3,5-dimethyl-4-methylthiophenyl methylcarbamate
Bayer 39007 ..... O-isopropoxyphenyl methylcarbamate
Bayer 41831 ..... O,O-dimethyl O-(4-nitro-m-tolyl) phosphorothioate
Dupont 691 ..... O-ethyl O-(p-nitrophenyl) chloromethylphosphonothioate
Geigy 24027 ..... O,O-diethyl O-(3-methyl-5-pyrazolyl) phosphorothioate
Geigy 30493 ..... S-(3,4-dichlorophenylthio)methyl O,O-dimethyl phosphorodithioate
Geigy 30494 ..... S-(2,5-dichlorophenylthio)methyl O,O-dimethyl phosphorodithioate
General Chemicals 3561.. dimethyl 2-(1,1,3,3-tetrafluoro-2-hydroxy)propylphosphonate
General Chemicals 3583.. 2-chloro-1-(2,5-dichlorophenyl)vinyl diethyl phosphate
General Chemicals 4072.. 2-chloro-1-(2,4-dichlorophenyl)vinyl diethyl phosphate
Hercules 3895..... 2,2-bis(ethylthio)vinyl diethyl phosphate
Hercules 5727..... m-isopropylphenyl methylcarbamate (also Union Carbide 10854)
Kepone ..... decachlorooctahydro-1,3,4-metheno-2H-cyclobuta(cd)-pentalen-2-one
LS 4443 ..... triphenyl tin acetate
Monsanto CP-9533 ..... reaction product of s-trithiane-p-chlorobenzesulfenyl chloride adduct and triethyl phosphite
Monsanto CP-10561 ..... reaction product of s-trithiane-p-chlorobenzenesulfenyl chloride adduct and trimethyl phosphite
Monsanto CP-10878 ..... reaction product of s-trithiane trichloromethanesulfenyl chloride adduct and triethyl phosphite
Monsanto CP-11549 ..... O,O-diethyl S-(2-propynyl) phosphorothioate
Monsanto CP-11903 ..... O,O-diethyl S-pentachlorophenyl phosphorothioate
Monsanto CP-12432 ..... diethyl 1-(dimethoxyphosphinyl)vinyl phosphate
Shell SD-4294 ..... dimethyl 1-(alpha-methyl-benzyloxycarbonyl)-1-propen-2-yl phosphate

Shell SD-4457	1-(2,4-dichlorobenzyloxycarbonyl)-1-propen-2-yl dimethyl phosphate
Shell SD-5533	dimethyl 1-(p-nitrobenxyloxycarbonyl)-1-propen-2-yl phosphate
Shell SD-5539	dimethyl 1-(m-nitrobenxyloxycarbonyl)-1-propen-2-yl phosphate
Stauffer R-1448	O,O-diethyl S-phthalimidomethyl phosphorodithioate
Stauffer R-1504	O,O-dimethyl S-phthalimidomethyl phsophorodithioate
Stauffer R-1505	O,O-diethyl S-phthalimidomethyl phosphorothioate
Velsicol 53-CS-17	1,4,5,6,7,8,8-heptachloro-2,3-epoxy-3a,4,7,7a-tetrahydro-4,7-methanoindan

Table 1.--Toxicity of various compounds to larvae of the southern potato wireworm in laboratory cages

Compound	Formulation	Equivalent pounds of toxicant per 6-inch acre	Cumulative percent mortality[1/] after--				
			3-5 Days	3 Weeks	5 Weeks	7 Weeks	9 Weeks
Bayer 22408	WP	20	70	94	100	--	--
		2	5	21	26	22	24
Bayer 24498	EC	20	85	83	77	73	73
		2	0	0	0	8	8
Bayer 22684	EC	2	5	0	11	11	17
Bayer 25141	EC	2	11	76	88	100	--
		1	0	5	5	5	5
Bayer 25198	EC	2	5	0	0	0	0
Bayer 28589	WP	20	90	100	--	--	--
		10	45	83	84	92	92
		2	30	61	46	53	53
Bayer 29493	EC	2	75	78	81	88	88
		0.25	0	0	0	14	14
Bayer 29952	EC	20	100	--	--	--	--
		2	100	--	--	--	--
		0.25	15	6	0	0	0
Bayer 30237	EC	20	100	--	--	--	--
		2	100	--	--	--	--
		0.25	45	33	43	33	33
Bayer 30468	EC	20	100	--	--	--	--
		2	100	--	--	--	--
		0.25	15	7	21	8	17
Bayer 30554	EC	20	100	--	--	--	--
		2	5	12	8	0	0
Bayer 30911	EC	20	100	--	--	--	--
		2	95	94	93	93	93
		0.25	5	6	0	0	0

Table 1.--Continued

Compound	Formulation	Equivalent pounds of toxicant per 6-inch acre	Cumulative percent mortality[1/] after--				
			3-5 Days	3 Weeks	5 Weeks	7 Weeks	9 Weeks
Bayer 34042	EC	5	100	--	--	--	--
		2	63	69	61	60	56
Bayer 34098	WP	20	100	--	--	--	--
		2	21	21	25	21	21
Bayer 37344	WP	20	60	60	60	60	60
		2	0	0	0	5	10
Bayer 39007	WP	20	85	100	--	--	--
		2	25	33	44	44	36
Bayer 41831	EC	20	95	100	--	--	--
		2	100	--	--	--	--
		0.25	10	10	11	11	11
Dimethoate	EC	2	0	0	15	8	8
Dupont 691	EC	2	15	55	59	53	60
Geigy 24027	EC	20	5	50	46	46	46
Geigy 30493	EC	20	26	38	23	0	0
		2	5	0	0	8	23
Geigy 30494	EC	2	10	28	54	54	64
General Chemicals 3561	EC	2	0	17	17	17	17
General Chemicals 3583	EC	2	40	89	87	94	93
		1	0	15	15	15	15
General Chemicals 4072	EC	2	10	72	81	94	93
		1	0	5	35	35	35
Hercules 3895	EC	2	20	17	22	22	22
Hercules 5727	EC	2	60	67	72	83	83
Kepone	WP	20	5	26	47	47	50
LS 4443	EC	20	0	0	30	40	40

Monsanto CP-9533	EC	2	10	17	28	33	33
Monsanto CP-10561	EC	2	0	5	10	18	12
Monsanto CP-10878	EC	2	5	0	0	0	40
Monsanto CP-11549	EC	2	100	--	--	--	--
		0.25	10	28	31	31	31
Monsanto CP-11903	EC	2	0	5	0	0	0
Monsanto CP-12432	EC	2	0	16	8	8	9
Pentachloronitrobenzene	WP	40	16	68	94	100	--
		20	0	0	0	0	0
Ronnel	EC	2	30	61	59	53	53
Shell SD 4294	EC	20	45	50	46	54	54
Shell SD 4457	EC	20	0	0	0	0	8
Shell SD 5533	EC	20	0	0	0	0	0
Shell SD 5539	EC	20	0	6	0	0	0
Stauffer R-1448	EC	2	0	18	44	40	36
Stauffer R-1504	EC	2	0	0	0	0	0
Stauffer R-1505	EC	2	0	0	0	0	0
Velsicol 53-CS-17	EC	20	40	67	81	88	94
		10	40	56	64	71	78
		5	20	0	7	7	14
Standards							
DDT[2/]	EC	20	61	80	82	83	83
Parathion[3/]	EC	0.25	55	69	70	72	71

1/ Adjusted for untreated check.
2/ Average of 16 tests.
3/ Average of 14 tests.

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